CULVER DUCK FARMS:
ANAEROBIC DIGESTER COMBINED HEAT AND POWER PROJECT: CONCEPT TO REALITY

Five Generations of Excellence
Culver Duck

OWS
Organic Waste Systems

Specialty Concrete Construction
Agricultural - Commercial - Residential

JPR Jones Petrie Rafinski


Five Generations of Excellence
Culver Duck
OWS
Organic Waste Systems
Specialty Concrete Construction
Jones Petrie Rafinski

DETERMINING THE FEASIBILITY FOR CULVER DUCK FARMS RENEWABLE ENERGY PROJECT

FIRST STEPS

- ❑ Preliminary evaluation
  - ❑ Current consumption cost
  - ❑ Biomass volumes
  - ❑ Biomass productivity
- ❑ Identify potential alternatives
- ❑ Conduct a full financial and technical feasibility study

Five Generations of Excellence
Culver Duck

OWS
Organic Waste Systems

Specialty Concrete Construction
AGRICULTURAL · COMMERCIAL · RESIDENTIAL

JPR Jones Petrie Rafinski

DETERMINING THE FEASIBILITY FOR CULVER DUCK FARMS RENEWABLE ENERGY PROJECT

TOPICAL DEVELOPMENTS

- ❑ Existing Net Metering Rules (2004)
- ❑ IURC/Investor Owned Utility Net Metering Rule mandate (2011)
- ❑ Technology developments continue (at an accelerating rate)
- ❑ Investor-owned utility partnerships (continues)

Idea Lobbyist – laura.arnold@thearnoldgroupbiz www.indianadg.net
Clean Energy (US DOE) – www.midwestcleanenergy.org
Indiana Office of Energy Development - www.in.gov/oed
Database of State Incentives – www.dsireusa.org

Five Generations of Excellence
Culver Duck

OWS Organic Waste Systems

Specialty Concrete Construction

JPR Jones Petrie Rafinski

DETERMINING THE FEASIBILITY FOR CULVER DUCK FARMS RENEWABLE ENERGY PROJECT

FUNDING OPTIONS

- ❑ Self-funded project - (converts underperforming municipal or private deposits to income producing resource)
- ❑ ESCO concept or guaranteed savings
- ❑ USDA Grant/Loan program
- ❑ State Revolving Loan program (municipal only)
- ❑ Combination of 3-P, utility capital improvement funds, revenue bond or other
- ❑ Industrial development bond
- ❑ Tax increment finance district, Tax phase-in
- ❑ PACE programs (in Michigan or Ohio)

USDA

STATE REVOLVING FUND PROGRAM

Five Generations of Excellence
CULVER Duck

OWS Organic Waste Systems

SPECIALTY CONCRETE CONSTRUCTION
AGRICULTURAL · COMMERCIAL · RESIDENTIAL

JPR JONES PETRIE RAFINSKI

DETERMINING THE FEASIBILITY FOR CULVER DUCK FARMS RENEWABLE ENERGY PROJECT

POTENTIAL REVENUE STREAMS

- ❑ Incremental savings in utility costs
- ❑ Feed-in or net metering rates from utility
- ❑ Interest income from self-funded projects
- ❑ Investment tax credits
- ❑ Sale of energy credits
- ❑ Tipping fees
- ❑ Production tax credits
- ❑ Carbon credits

Five Generations of Excellence
Culver Duck

OWS Organic Waste Systems

Specialty Concrete Construction
Agricultural · Commercial · Residential

JPR Jones Petrie Rafinski

CASE STUDY
CULVER DUCK FARMS, MIDDLEBURY, INDIANA

Culver Duck is one of the top two duck producers in the U.S.

A 5-generation, family built and operated duck farming and processing business with a 130-year history.

- ❑ Significant consumer of electricity and gas
- ❑ Significant producer of animal process by-products (480,000 ducks/week)
- ❑ A need and desire to achieve zero discharge of waste materials
- ❑ As a business, Culver has always been committed to a ‘sustainable’ model

Five Generations of Excellence
CULVER Duck

OWS
Organic Waste Systems

SPECIALTY CONCRETE CONSTRUCTION
AGRICULTURAL · COMMERCIAL · RESIDENTIAL

JPR JONES PETRIE RAFINSKI

CASE STUDY
CULVER DUCK FARM, MIDDLEBURY, INDIANA

- Preliminary study in 2010 showed project convert the operation's process waste to energy. After careful consideration, the Culvers decided to proceed.
- JPR and OWS partner for substrate testing, viability and estimated cost of the proposed project. Completed detailed study that showed an attractive Return on Investment (ROI) ($6 million ROI in less than 5 years).
- NIPSCO announced a renewable energy portfolio offering in 2011; submitted application. NIPSCO selects project; Agreement signed (15-year power purchase at 1.2MW).
- Design/build process with JPR, Specialty Concrete Construction, OWS, and the Culver project team. Construction began 3Q 2011 and went on line in 4Q 2012.

Five Generations of Excellence
Culver Duck

OWS
Organic Waste Systems

Specialty Concrete Construction
SCC
AGRICULTURAL · COMMERCIAL · RESIDENTIAL

JPR Jones Petrie Rafinski

COMPOSITION

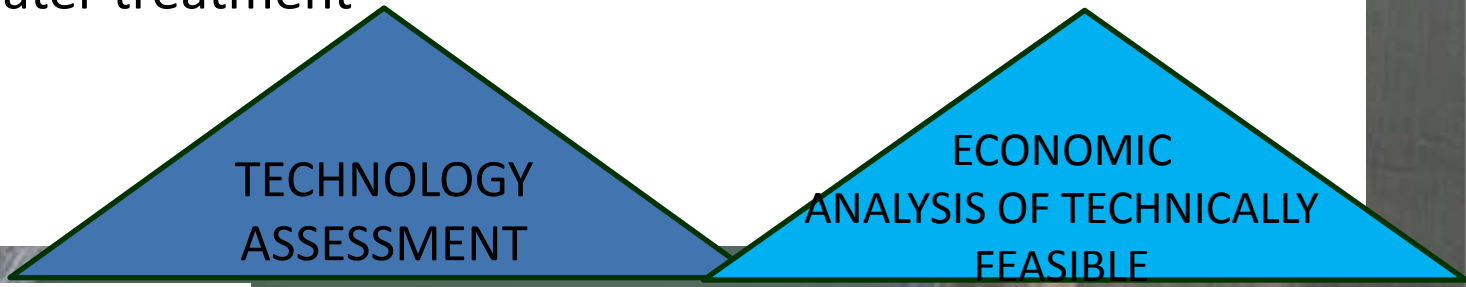
- **COLLECTION AND COMPOSITION DYNAMICS**
  - Number of sources, seasonality, cyclicality, variability in primary organics physical characteristics and composition
  - Type and size of contamination
  - Storage requirements, odor potential
  - Implications for pretreatment systems, wet vs. dry digestion
- **LABORATORY ANALYSIS**
  - Analyses (TS, VS, Kj-N, C:N, Heavy Metals)
  - Biogas Production Potential (Total Biogas, CH4%, % BVS)
  - Hydrogen Sulfide Production Potential (inhibition potential)
  - Digestate Chemical Composition (including Heavy Metals)
  - Implications for Digestion Temperature, Digestate Treatment, Energy Production and Use

FEEDSTOCK ANALYSIS

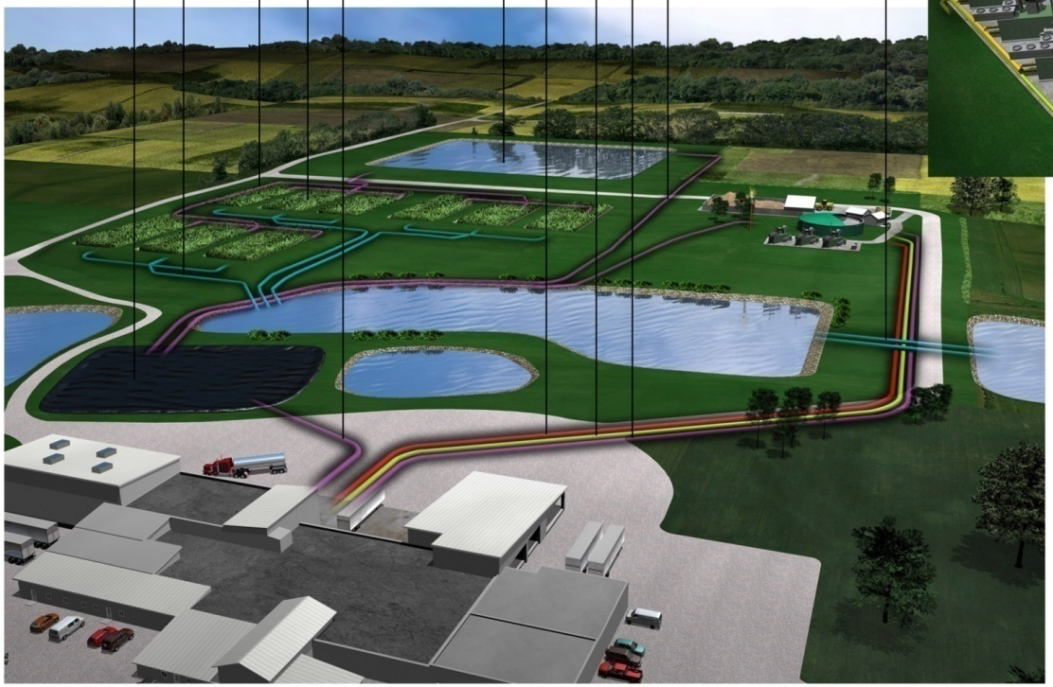
CLIENT & SITE REQUIREMENTS

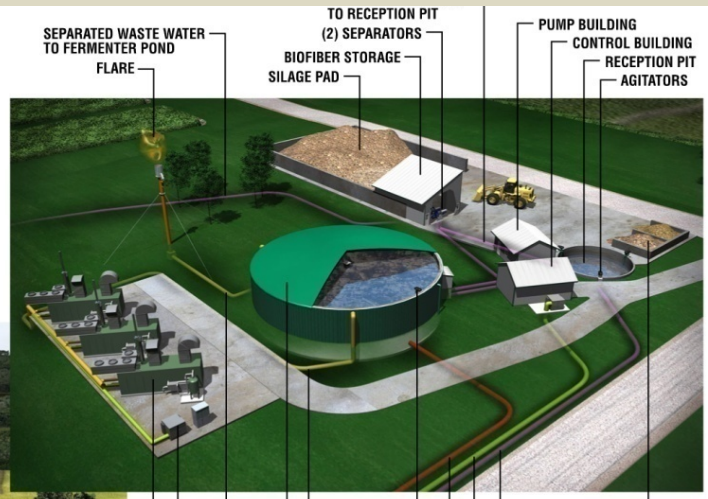
COMPOSITION AFFECTS DIGESTION SYSTEM SELECTION

- Composition impacts cost and feasibility of wet and dry digestion technology options
  - Pre-treatment equipment requirements
  - Water addition/removal
  - Parasitic heat and power load, fuel needs, labor
  - Plant layout and surface area requirements
  - Operational reliability parameters
  - Biogas productivity implications
  - Plant emissions and odors
  - Wastewater treatment



CASE STUDY
CULVER DUCK FARMS, MIDDLEBURY, INDIANA





Graphic prepared by:
Dave Westberg

The Master's Touch

Culver Duck

OWS Organic Waste Systems

Specialty Concrete Construction

Jones Petrie Rafinski

CASE STUDY
CULVER DUCK FARMS, MIDDLEBURY, INDIANA

- 85’ diameter digester capable of holding 933 million gallons
- Three 400 KW biogas generators (2G Cenergy)
- Control building – uses specialized digester process software
- 35’ diameter reception/ mixing pit for silage
- Pump building
- Ferrous Chloride and Co-Feed Tanks

Five Generations of Excellence
Culver Duck

Organic Waste Systems

Specialty Concrete Construction
Agricultural - Commercial - Residential

Jones Petrie Rafinski

LESSONS LEARNED

- Avoid winter startups
- Coordinate with genset provider for partial load, gradual startup
- Co-feeds come and go, highly competitive
- Know your mixing capability limits as substrates change
- USDA grant process/timing incompatible

USDA

Five Generations of Excellence
CULVER Duck

OWS
Organic Waste Systems

SPECIALTY CONCRETE CONSTRUCTION
AGRICULTURAL · COMMERCIAL · RESIDENTIAL

JPR JONES PETRIE RAFINSKI

CASE STUDY
CULVER DUCK FARM, MIDDLEBURY, INDIANA

CURRENT CO-FEEDS:

105,000 gallons duck blood and offal – weekly

10 tons of corn stover – daily

5 tons of potato waste – daily

1-4 tons of corn dog waste – daily

20 tons from Meijer Central Kitchen - weekly

- **Produces up to 1.2 MW of electricity – enough to operate Culver main plant and hatchery with energy left over during average energy usage to power about 60 homes.**
- **Will provide waste heat to replace ~75% of the farm's purchased natural gas.**
- **Eliminated trucking of processing wastes**
- **Enhances management of residual nutrients in Culver's wastewater in a responsible manner, reducing odors and increasing agronomic benefits.**

Culver Duck

OWS Organic Waste Systems

Specialty Concrete Construction

Jones Petrie Rafinski

CASE STUDY
CULVER DUCK FARM, MIDDLEBURY, INDIANA

- Reduces carbon emissions by 11,000 tons/year
- Produces rich, organic compost
- Successful implementation of AD technology for duck wastes - particularly challenging due to high nitrogen content
- 300,000 gallons of nitrogen-rich wastewater now treated in constructed wetlands and storage lagoon which functions even in cold weather at nearly 100% efficiency
- Water recycled via spray irrigation back to Culver corn fields, feed production

Five Generations of Excellence
Culver Duck

OWS
Organic Waste Systems

Specialty Concrete Construction
Agricultural · Commercial · Residential

JPR Jones Petrie Rafinski


25 YEARS OWS
1988 - 2013
Thank you for your attention
American biogas Council
Promoting the Anaerobic Digestion and Biogas Industry
Norma McDonald
norma.mcdonald@ows.be